This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

GIFT OF

SIGILLVM · VNIVERSITATIS · CALIFORNIENSIS
FIAT LVX
MDCCCLXVIII

EX LIBRIS

No. 1666

DESCRIPTION OF THE
DEFLECTION BOARD, MODEL OF 1905, FOR GUNS

MECHANICAL FEATURES, METHOD OF ASSEMBLYING
AND DISMOUNTING, AND RULES GOVERNING ITS
CARE AND PRESERVATION IN SERVICE

(*ONE PLATE*)

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

JANUARY 26, 1906
REVISED JUNE 30, 1906
REVISED DECEMBER 9, 1908
REVISED JANUARY 26, 1912

WASHINGTON
GOVERNMENT PRINTING OFFICE
191

No. 1666

DESCRIPTION OF THE

DEFLECTION BOARD, MODEL OF 1905, FOR GUNS

MECHANICAL FEATURES, METHOD OF ASSEMBLYING AND DISMOUNTING, AND RULES GOVERNING ITS CARE AND PRESERVATION IN SERVICE

(*ONE PLATE*)

JANUARY 26, 1906
REVISED JUNE 30, 1906
REVISED DECEMBER 9, 1908
REVISED JANUARY 26, 1912

ORDNANCE DEPARTMENT. U.S.A.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

UF856
D4U6
1917

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, January 26, 1912.

This manual is published for the information and government of the Regular Army and National Guard of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

362108

TABLE OF CONTENTS.

	Page.
Assembling and dismounting	10
Care and preservation	12
Construction	8
Deflection scale	8
Description	7
Drift scale	9
Operation	11
Platen scale	9
Range-time scale	10
Service-wind scale	8
To test adjustments	12

UNIV. OF CALIFORNIA

DESCRIPTION OF THE DEFLECTION BOARD, MODEL OF 1905, FOR GUNS.

(1 PLATE.)

1. The deflection board, model of 1905, for guns, is an adding machine by means of which the corrections for travel in azimuth during the observation interval and the time of flight, for drift, and for deflection due to wind are automatically added (algebraically), and the total azimuth correction to be made on the gun arm of the plotting board or the deflection to be taken on the sight of the gun is indicated on the proper scale of the instrument.

2. The instrument consists of a built-up wooden board of cherry, upon which is mounted a sliding metal frame called the platen; this frame slides upon a rod to which it is attached by two trammels. The left-hand trammel carries a clamp screw by means of which the platen may be locked to the rod. The rod works in two bearings mounted on the board. The left end of the rod is threaded. This thread, in conjunction with a milled handwheel and nut, forms a translating mechanism by means of which, when the clamp screw is tightened, a slow motion may be given to the platen. Attached permanently to the board are the deflection scale, the service wind scale, the subcaliber wind scale, and the wind arm. Attached to the platen and moving with it are the drift scale, the travel arm, the platen scale (15-second), and the platen scale (30-second). Attached to and sliding on the rod is the range-time scale. Secured between the deflection scale and a lower bearing strip, and sliding between them in undercut grooves, is the azimuth correction scale. Boards of serial numbers below 140 have a travel scale in place of bearing strip mentioned above. This scale is now obsolete.

3. The center about which the travel arm revolves is called the "center of the platen." A plane passing through the center of the platen, normal to the surface of the base and parallel to the longer edge of the board, will trace on the platen a line called the "reference line." The straight line through the center of the platen and perpendicular to the reference line is called the "median line." The straight line on the board, passing through the reference number 3 on the deflection scale perpendicular to the reference line, is called

the "axis of the board." The name "drift axis" is given to the line through the center of the wind arm perpendicular to the reference line.

4. The deflection scale is graduated to correspond to the deflection scale of sights. Its reference numbers range from 0 to 6, reading from left to right, and 3 is located on the axis of the board. In Case II the deflection scale of the sight is set to read the deflection noted on the deflection scale of the board. The azimuth correction scale is graduated from left to right, with the reference number 15 in the center of the scale. This scale indicates the azimuth correction to be applied to the gun arm on the plotting board in Case III. Each scale is graduated to a scale of 2 inches to a degree, one-tenth inch being equivalent to five one-hundredths (0.05) degree, which is the least reading.

5. The wind arm and wind scales are used in conjunction with the drift scale in determining the correction for deflection due to wind. The wind arm is attached to the screw bearing (left), and revolves about a center on the reference line, so located that the origin of the curve on the drift scale coincides with it when the median line of the platen and the axis of the board coincide. The arm is serrated on its rear edge to distinguish that edge from the fiducial edge. The service and subcaliber wind scales are so graduated that when the arrow index on the wind arm is set at the reference number 50 on either wind scale, the fiducial edge of the wind arm will be perpendicular to the reference line. This position of wind arm represents a lateral wind component of zero magnitude. Each subdivision of the wind scale represents the angle at which the wind arm must be set for a difference in the lateral wind component of 10 miles per hour. The reference number 0 on the wind scale represents a lateral wind component of 50 miles per hour, causing deflection of the projectile to the right, and the reference number 100 on the wind scale represents a lateral wind component of 50 miles per hour, causing left deflection. These graduations correspond to those on the wind-component indicator.

In the construction of the board, any arbitrary angle might represent a given lateral wind component provided the drift scale were designed accordingly. It was found convenient to use tan $\alpha=0.0043$ W, in which W is the velocity of the wind in miles per hour, and α, the angular deviation of the wind arm from its initial position, which represents a lateral wind component of zero magnitude.

The service wind scale is the same for all calibers of guns. Slots in the service wind scale, through which securing screws pass, allow the necessary amount of adjustment for the expansion and contraction of the wooden board. If the base expands, the securing screws should be slightly loosened and the wind scale adjusted to permit of easy motion of the wind arm. The latter, in revolving around its center, travels over a raised bearing strip between the service wind scale and the subcaliber wind scale, which prevents its scratching the surface of the latter scale.

6. The drift scale is secured to the left edge of the platen by two knurled thumbscrews. The drift scale differs for each caliber of gun and for each muzzle velocity of the projectile. Its function is to correct, together with the wind arm, for the deflection of the projectile due to the wind, and for drift. The range graduations on the drift scale are so located that, for the wind arm set to a given reference number on the wind scale, the distance from the drift axis to that point on the wind arm, which is the intersection of a line through the given range reading on the drift scale perpendicular to the axis of the board with the edge of the wind arm, measures the wind deflection for the given wind component at the given range. Assuming the origin of drift curve to be at zero range, the abscissas of the several points on the curved edge correspond to the drift of the projectile for the given range. Movement of the platen bringing any point of the drift scale to the drift axis therefore advances the median line of the platen a distance from the axis of the board equal to the drift. By setting the wind arm opposite the given wind-scale reference number and advancing the platen until the edge of the wind arm meets the edge of drift curve opposite the given range graduation on the drift scale, the deflection due to the given lateral wind component and the drift for the given range are added algebraically.

Two drift scales are furnished with each board, one for the particular gun with which the board is to be used and the other for the 1-pounder subcaliber gun. The subcaliber drift scale is furnished graduated in yards. When the board is to be used for the subcaliber gun the drift scale for the service gun should be removed and the subcaliber drift scale secured to the platen in its stead. In securing the scale to the platen the zero range graduation must coincide with the reference line.

7. Attached to the platen is the 15-second platen scale. This scale represents the angular travel of the target in azimuth during 15 seconds, and the graduations are to the same scale as those on the deflection and azimuth correction scales. The numbers run from left to right, the reference number at the origin (median line of platen) being 15°, to correspond to the azimuth correction scale of the plotting board. The maximum reading allows for a setting of 5° either to the right or to the left. This corresponds to a speed of the target of about 12 miles (10 knots) per hour at 1,000 yards range, or 24 miles (20 knots) per hour at 2,000 yards, etc. The right edge of the travel arm of boards Nos. 1 to 139, inclusive, but the left edge of boards after No. 139, is the fiducial edge; the other edge is scal-

loped to prevent the taking of reading from that side. The purpose of this scale is to correct for travel of the target during the time of flight of the projectile. To this end, an additional scale sliding over the platen, and known as the range-time scale, is provided.

8. The range-time scale is marked in terms of ranges, but is graduated for times of flight corresponding to those ranges (scale 1″=5 seconds). The 15-second platen scale is set at a distance from the reference line equal to 15 seconds (3 inches). A movement of the range-time scale from the median line in bringing a given range reading to the travel arm for that arm set to a given travel solves the following proportion: 15 seconds interval: travel of target in 15 seconds::time of flight interval (read in terms of range): travel of target during time of flight. When thus set, the range-time scale is at a distance from the median line which is the measure of the travel of the target during the time of flight.

Two range-time scales are furnished with each board, one for the particular gun with which the board is to be used and one for the 1-pounder subcaliber gun. The subcaliber range-time scale is furnished graduated in yards for ammunition of 2,000 f/s muzzle velocity.

9. For longer observation intervals an additional platen scale (30-second) is provided, which is graduated similarly to platen scale (15-second) with reference number 15 at median line. It is circular in form and is so graduated that for the travel arm set at a given reading on the platen scale (15-second), the platen scale (30-second) will read 15–2 [15– given reading on platen scale (15-second)].

10. It is sometimes necessary to add or subtract a constant deviation determined by the observation of fire. The instrument for observing fire will have a deflection scale graduated in the same manner as the sight scale, with the 3° mark in the center. An auxiliary scale is furnished with the deflection board graduated in the same manner as the scale of the observation instrument, but in the opposite direction. When an order is received to add or subtract a certain amount indicated by a reference number the auxiliary scale is laid over the deflection or azimuth correction scales so that the 3° mark will coincide with the fiducial edge of the range-time scale. The range-time scale is then moved to the indicated reference number on the auxiliary scale. The arbitrary correction is thus included in the total correction, whether it is read from the deflection scale or the azimuth correction scale.

ASSEMBLING AND DISMOUNTING.

11. The deflection board is issued assembled, with the exception of the proper drift scale and range-time scale, of which two sets are furnished with each board, as heretofore stated. The drift scale is

attached by means of two knurled thumbscrews, shown on the left of the platen; the range-time scale, by placing the end of the scale containing the pinhole in the slot of the range-time scale support. It is retained in place by a thumbscrew passing through the hole in the range-time scale and support.

12. It is not intended that the parts of the board other than the drift and the range-time scales be removed. If, however, at any time it becomes necessary to remove the platen itself from the board, the safety bolt in the upper part of the platen should first be removed, then the platen clamp screw loosened, the handwheel set screw loosened, the translating screw handwheel removed, and the translating screw nut unscrewed from the translating screw. The rod may then be removed from the bearings and the platen lifted from the board.

OPERATION OF THE BOARD.

13. The normal position of the board is the following: Index of wind arm at 50, wind arm vertical, origin of drift curve at center of pivot of wind arm, travel arm vertical—that is, parallel to the median line of the platen—the range-time scale also on this median line, the azimuth correction scale with figure 15 set opposite the index on the deflection scale. The reading edge of the range-time scale will then indicate 3 on the deflection scale and 15 on the azimuth correction scale.

14. The successive operations are as follows:

(*a*) Set the wind arm to the proper reference number on the wind scale, as is indicated by the wind component indicator.

(*b*) Move the platen so that the curved edge of the drift scale intersects the straight edge of the wind arm at the point on the drift scale which reads the range received from the gun arm of the plotting board.

(*c*) If the observation interval be 15 seconds, set the fiducial edge of travel arm so that it intersects the reference line of platen scale (15-second) at the travel reference number given by the plotting board. If the observation interval be 30 seconds, set the travel arm so that it intersects the platen scale (30-second) at the given travel reference number.

(*d*) Set the range-time scale so that it intersects the fiducial edge of the travel arm at the given range received from the plotting board.

(*e*) For Case II read the total deflection from deflection scale where the deflection scale is cut by the fiducial edge of the range-time scale.

(*f*) For Case III the movement of the target during the observation interval must be added to the other deflection correction. To obtain this, move the azimuth correction scale until the reference number representing the travel of the target during the given observation interval is opposite the index or median line on the deflection scale. At the intersection of the fiducial edge of the range-time scale with the azimuth correction scale, read the azimuth correction to be set off on the plotting board.

TO TEST ADJUSTMENTS.

15. The reference line should pass through the center of the axis of the wind arm and the travel arm. This line is inscribed on the face of the platen. The fiducial edge of the travel arm should be a straight edge, and when placed perpendicular to the reference line should coincide with the median line. When turned to a horizontal position, either to the right or to the left, it shoud coincide with the reference line. The edges of the different range-time scales may be tested by bringing them parallel to the median line, which is also inscribed on the face of the platen. When the index indicates 50 on both wind scales the wind arm should be perpendicular to the reference line.

16. The deflection board should be tested at intervals for inaccuracies due to shrinking of the board or shifting of the scales. The following examples are provided as tests:

	Service.	Service.	Subcaliber.	Subcaliber.
Given:				
Interval, seconds	15	30	15	30
Wind scale, reference number.	10	90	35	65
Platen scale, reference number.	16	11	16	11
Range, yards	10,000	6,000	2,000	2,000
Results:				
Deflection scale, reference number.	8″ gun— 3.22 10″ gun— 3.32 12″ gun— 3.41	8″ gun— 1.83 10″ gun— 1.85 12″ gun— 1.85	2,000 f. s.— 2.54	2,000 f. s.— 2.54
Azimuth correction scale, reference number.	8″ gun—16.22 10″ gun—16.32 12″ gun—16.42	8″ gun— 9.83 10″ gun— 9.85 12″ gun— 9.85	2,000 f. s.—15.64	2,000 f. s.—10.64
Platen scale (30-second), reference number.	8″ gun—17.00 10″ gun—17.00 12″ gun—17.00		2,000 f. s.—17.00	
Platen scale (15-second), reference number.		8″ gun—13.00 10″ gun—13.00 12″ gun—13.00		2,000 f. s.—13.00

CARE AND PRESERVATION OF THE BOARD.

17. In order to prevent injury to the board while being moved about, the platen should be secured in position by means of the clamp screw. The travel arm should be placed in a position parallel to the reference line, and the azimuth scale should not project beyond the edge of the board.

18. A few drops of sperm oil should occasionally be put on the translating screw, the nut, the trammels of the platen, and the rod and its bearings. The sides of the azimuth correction scale, which slide in the bearings furnished by the deflection scale and the bearing strip, should also be occasionally oiled. No attempt should be made to polish the sand-blasted or lacquered surfaces of the board.

19. When the board is not in use, it should be kept covered to prevent the accumulation of dust on its surface and bearings.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, January 26, 1912.

January 26, 1906.
Revised June 30, 1906.
Revised December 9, 1908.
Revised January 26, 1912.
FORM No. 1666.
Ed. Apr. 2-17—500.
38766-70-1.

○